

SPECIAL REPORT

ON THE

WATER SUPPLY

OF

SAINT JOHN AND PORTLAND.

BY

GILBERT MURDOCH, C.E.,

SUPERINTENDENT SEWERAGE AND WATER WORKS.

MARCH, 1882.



SAINT JOHN, N. B.:

J. & A. McMILLAN, 98 PRINCE WILLIAM STREET.

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ENGINEERING DEPARTMENT,
SEWERAGE AND WATER WORKS,
ST. JOHN, March 22nd, 1882.

A. CHIPMAN SMITH, Esquire,
Chairman Sewerage and Water Commission.

DEAR SIR,—

The following brief Report, showing the extent, capacity and cost of the several works connected with the water supply of St. John and Portland; also, statements of annual revenue, and approximate estimates of the relative interest therein, of each place, is respectfully submitted.

EXTENT OF THE WORKS.

RESERVOIRS.—There are three (3) reservoirs connected with the water supply of St. John and Portland, viz.: the Leinster Street reservoir, built in 1836, in connection with the pumping works then established by the old Water Company. The Little River reservoir, built in 1850, when pumping was abandoned and gravitation adopted; and Lake Latimer, transformed into a Reservoir in 1851.

The regular daily supply of water for Town and City is taken directly from Little River reservoir, which has an area

of about 37½ acres and a surface elevation of 160 feet above City datum. Leinster Street reservoir is built of masonry, and has a capacity of about 300,000 gallons. It is used for fire purposes only; and the water of Lake Latimer for compensation purposes, during dry seasons. The latter has a surface area of 200 acres and an elevation of 300 feet above City datum. It was converted into a reservoir by damming the natural outlet, which carried its water into the Mispick, and connecting it by means of a conduit with Little River. The physical conditions of this Lake fit it admirably, in connection with Loch Lomond, for a high level service.

LEADING MAINS.—The water is brought to the City for distribution by three (3) cast iron mains, one of which is 12 inches in diameter, and was laid in 1851, by the old Water Company; and two (2) of 24 inches each, laid respectively in 1857 and 1873, by the Commissioners of Sewerage and Water Supply.

DISTRIBUTION.—The water brought to the City daily by these Mains is distributed to St. John and Portland by one hundred and sixty-nine thousand seven hundred and fifty (169,750) feet of cast iron pipe; attached to which are three thousand seven hundred and thirty-three (3733) service pipes for house supply, forty-nine (49) free hydrants for the use of the poor, one hundred and twenty-one (121) metres, two hundred and seventy-six (276) fire plugs, and four thousand four hundred and ninety-seven (4497) main and service stop cocks, including leading mains.

The main pipe ranges from 2 inches to 15 inches in diameter, and the service pipes from half inch to four (4) inches in diameter. Lead pipe is used for all services of one inch and under, and wrought or cast iron for services above one inch in diameter.

The relative lengths and sizes of main pipe and numbers of house services, free hydrants and fire plugs placed in Saint John and Portland respectively, are as follows, viz. :—

DISTRIBUTING PIPE.

	ST. JOHN.	PORTLAND.
15 inch Pipe, ...	4,150 feet.	8,027 feet.
12 " "	13,955 "	10,722 "
10 " "	7,821 "	2,151 "
8 " "	11,295 "	9,049 "
6 " "	40,678 "	14,057 "
4 " "	34,046 "	8,386 "
3 " "	4,855 "	158 "
2 " "	400 "	<i>Nil.</i>
Totals of Main Pipe, ...	117,200 feet.	52,550 feet.
Number of Service Pipes, ...	2,787	946
Do. Free Hydrants, ...	25	24
Do. Fire Plugs, ...	175	101
Do. Main Stop Cocks, ...	470	201
Do. Hydrants & Service Stop C'ks, ...	2,812*	970

* Exclusive of Stop Cocks on leading Mains.

CAPACITY OF WORKS.

The leading mains have a united length of sixty-nine thousand three hundred and twenty-five (69,325) feet, and a sectional area of about 1018 square inches. Their combined capacity of discharge is estimated at 350,000 imperial gallons per hour, or about 10,000,000 wine gallons per day; due allowance having been made for reduced diameters and retarded flow by incrustations.

COST OF THE WORKS.

The total cost of the Water Works on the 1st day of January last was \$987,471.50, or say in round number \$988,000, including debentures sold from time to time to meet annual deficiencies on interest and maintenance.

How much of the whole outlay belongs to interest and maintenance is unknown, and cannot be ascertained from the accounts kept by the late Commissioners, but is believed to have been considerable.

DIVISIONAL COST.

The above named amount of \$988,000 may be classed 1st, as General, and 2nd, as Special outlay, and divided approximately as follows, among the several parts or divisions of the Works, viz. :—

1ST.—GENERAL EXPENDITURE.

- (a) Cost of land and water rights, common to Town and City.
- (b) Cost of reservoirs inside and outside of the City, for storage of water.
- (c) Cost of leading mains used in conveying water from Little River to the Aboideau for distribution in St. John and Portland.
- (d) Leinster Street pipe yard, land and buildings,—including offices, workshops, stables, sheds and storehouses.
- (e) Value of pipe and other distributing stock on hand for general use, and not chargeable at present to Town or City.
- (f) Tools and general plant used in repairs and extensions.

2ND.—SPECIAL EXPENDITURE.

- (a) Cost of main and service pipe distribution in St. John.
- (b) Cost of main and service pipe distribution in Portland.

ESTIMATIONS OF COST.

1ST—GENERAL EXPENDITURE.

(a) *Land and Water Rights.*

Loch Lomond & Lake Donaldson,	\$3,770.00	
Lake Latimer and Miskeck, ...	2,040.00	
Little River, ...	3,265.00	
		\$9,075.00

(b) *Reservoir and Appendages.*

Leinster Street, ...	6,000.00	
Little River, ...	14,127.00	
Lake Latimer and Conduit, ...	2,000.00	
		22,127.00

(c) *Leading Mains.*

12 inch Main, laid 1851, ...	108,100.00	
24 inch " " 1857, ...	219,894.00	
24 inch " " 1873, ...	219,894.00	
		547,888.00

(d) *Leinster Street Pipe Yard.*

Land Leinster and King Streets,	6,000.00	
Building do.,	9,000.00	
		15,000.00

(e) *Stock on hand.*

Cast Iron Pipe, ...	11,811.78	
Special Castings, ...	778.02	
Main Stop Cocks, ...	553.00	
Lead Pipe, ...	3,036.77	
Brass Work, ...	102.96	
Meters, Crown and Worthington,	944.85	
Pig and Scrap Lead, ...	1,134.30	
Sundries, Straps, Stop Cock Boxes,		
Spun Yarn, &c., ...	128.55	
		18,490.23

(f) *Tools and other Plant, (exclusive of
Sewerage,)*

.....	822.72	
		822.72

Total estimated cost of Works, ex- clusive of distribution, ...	374,597.05	
		613,402.95

2ND—SPECIAL EXPENDITURE.

(a) *Distribution, St. John.*

4,150 ft. 15 inch Pipe, @ \$4.00,	\$16,600.00
13,955 ft. 12 do. @ 3.30,	46,051.50
7,821 ft. 10 do. @ 2.50,	19,552.50
11,295 ft. 8 do. @ 2.00,	22,590.00
40,678 ft. 6 do. @ 1.35,	55,915.30
34,046 ft. 4 do. @ 1.00,	34,046.00
4,855 ft. 3 do. @ .90,	4,369.50
400 ft. 2 do. @ .80,	320.00
2,737 Service Pipes, @ 15.00,	41,805.00
25 Free Hydrants, @ 14.00,	350.00

St. John cost of distribution, ... 241,599.80

(b) *Distribution, Portland.*

8,027 ft. 15 inch Pipe, @ \$4.00,	32,108.00
10,722 ft. 12 do. @ 3.30,	35,382.60
21,151 ft. 10 do. @ 2.50,	5,377.50
9,049 ft. 8 do. @ 2.00,	18,098.00
14,057 ft. 6 do. @ 1.35,	18,976.95
8,386 ft. 4 do. @ 1.00,	8,386.00
158 ft. 3 do. @ .90,	142.20
946 Service Pipes, @ 15.00,	14,190.00
24 Free Hydrants, @ 14.00,	336.00

Portland cost of distribution, ... 132,997.25

Total cost, ... \$988,000.00

The foregoing figures are not put forth as absolutely correct in every particular, as they might have been had the accounts of the late Commissioners been kept in a way to show the outlay on each particular street and section of the work.

Unfortunately, for the present enquiry, this has not been the case, and all that can be accomplished now is to approximate the cost of the several parts with as much accuracy as possible. This has been done; and the results are shown above.

The process has been laborious and somewhat tentative; but as the calculations of cost, etc. have been made from data derived from experience, the results are submitted with confidence as sufficient for all practical purposes.

COST PER FAMILY.

As the capital cost per family is often taken as a standard of comparison between works of a similar character in different cities, it may be remarked that this information will be obtained by dividing the general outlay and the total cost of the works respectively by 6235, the number of families residing in the water districts of St. John and Portland in 1881, as follows, viz. :—

$$\begin{array}{lcl} \text{Average of General Outlay, } \$\frac{613,402.95}{6235} & = & \$98.38 \text{ per family.} \\ \text{" Total cost, } \$\frac{8,000}{6235} & = & 158.46 \text{ do.} \end{array}$$

ASSESSMENT RETURNS.

The following summary of the assessment returns, which form the basis of the current year's assessment, shows some of the many uses to which the water is put in St. John and Portland, together with the estimated value of rateable property, and revenues accruing from assessments and agreements in each case.

FAMILIES, FACTORIES, &c.

Number of Families, ...			St. John,	3878	
Do. "			Portland,	2357	
				—	6235
Factories, Mills and Workshops, ...			St. John,	304	
Do. " "			Portland,	85	
				—	389
Hotels and Boarding Houses, ...			St. John,	66	
Do. " "			Portland,	6	
				—	72

Schools,					St. John,	11	
Do.					Portland,	3	
							14
Steam Engines,					St. John,	33	
Do.					Portland,	19	
							52
Saloons, Shops and Taverns,					St. John,	663	
Do. " "					Portland,	26	
							927
Water Closets,					St. John,	1954	
Do.					Portland,	84	
							2078
Baths,					St. John,	717	
Do.					Portland,	43	
							760
Country Stabling: Stalls,					St. John,	112	
Do. " "					Portland,	151	
							263
Horses,					St. John,	634	
Do.					Portland,	232	
							866
Cows,					St. John,	24	
Do.					Portland,	71	
							95

ESTIMATED VALUATION OF RATEABLE PROPERTY.

Furniture and personal property, \$600 and upwards, St. John,			\$858,700.00	
Furniture and personal property, \$600 and upwards, Portland,			139,600.00	
				\$998,300.00
Stocks-in-Trade value, \$400 and upwards, St. John,			2,820,200.00	
Portland,			680,500.00	
				3,500,700.00
Real Est., includ'g bldgs. & imp'ts thereon, St. John,			9,983,150.00	
Portland,			2,631,550.00	
				12,614,700.00
Total of Estimated Value, ...				\$17,113,700.00

Dividing the above named values of rateable property by the number of families in St. John and Portland respectively, the following results are obtained, viz. :—

CLASSIFICATION OF PROPERTY.	St. John Average per Family.	Portland Average per Family.
Furniture and Personal Property, ...	\$221 43	\$59 22
Stocks-in-Trade, ...	727 23	288 71
Real Estate and Buildings thereon, ...	2,574 30	1,116 48
Totals, ...	\$3,522 96	\$1,464 41

The total of the rateable property returned for St. John in 1881 was \$13,662,050, and for Portland \$3,451,650, or in other words, St. John furnished 79.83 per cent. of the property assessed in 1881 for the maintenance of the Water Works, and Portland 20.17 per cent.

REVENUE FROM WORKS.

The total assessment levied for water purposes during the current year was \$68,099.90, and amount receivable from agreement customers for the year ending February 1st, 1882, \$9,279.33, or a combined total of \$77,379.23.

The amounts accruing from St. John and Portland respectively, from both sources, were as follows, viz. :

St. John Assessment, ...	\$53,449 60	
Do. Agreements, ...	5,158 51	
		\$58,608 11
Portland Assessments, ...	14,650 30	
Do. Agreements, ...	4,120 82	
		18,771 12
Total, ...		\$77,379 23

It appears from the foregoing figures that the amount required during the current year to meet interest and mainte-

nance and loss in collections, is equal to an average rate per family of \$12.41 fully; and that the relative amounts actually levied are equal to an average in St. John of about \$15.11, and in Portland to an average of about \$7.96½ per family,—including moneys accruing from agreements as well as from assessments.

And in regard to the former, it may be explained here that credit is given to Portland for all the factories on the northern side of the City Road, which could and would have been supplied had the works remained in the hands of the original Water Company, or become the exclusive property of the City. The foundry and machine works of James Harris & Co. and the steam saw mill of Messrs. Kirk & Daniel, are also credited to Portland, though part of the premises belonging to each is in the City, and both were supplied with water from the mains, while the works were yet owned by a Company.

Had the whole amount of money required during the current year for interest and maintenance been raised by an equally proportioned family rate alone, the gross amount in each place would have been as follows, viz. :—

ST. JOHN—\$12.41046 x 3878 families, ...		\$48,127 76
Actual amount levied, ...		58,608 11
Difference in excess, ...		<u>\$10,480 35</u>
PORTLAND—\$12.4103 x 2357 families, ...		\$29,251 46
Actual amount levied, ...		18,771 12
Difference short of what it would have been, ...		<u>\$10,480 34</u>

Before leaving this branch of the enquiry, it may be noted that there is *one* service pipe in St. John for each 42 feet of main laid, and *one* in Portland for each 55½ feet; and that the revenue derivable from each 1000 feet of main pipe laid in the City is about \$500.07, while the average in the Town is about \$357.20½.

The total cost of distribution, exclusive of fire hydrants—which are paid for by St. John and Portland respectively, and do not form any part of the water debt proper—is \$374,597.05 and of this amount 64.48 per cent. has been spent in the City, and 35.52 per cent. in Portland.

The last question to be considered in this enquiry is the

RELATIVE INTEREST,

or proportion of the total capital outlay in connection with water supply should be reasonably debited to St. John, and how much to Portland, and measure as it were the relative yearly liability of each, in the matter of interest and maintenance.

This is a difficult question to solve, and can be approximated only, no matter what consideration or care is given to it. The chief obstacle in the way of a satisfactory solution is the absence of a recognized standard of value, or test by which the respective interests of Town and City could be ascertained. There is no substantial difficulty with the distributing works. The relative value of these can be readily and accurately reached, but the difficulty begins with the question how much of the *General Expenditure*, made on account of land and water rights, leading mains and reservoirs, gate-houses and waste-ways is fairly chargeable to St. John, and how much to Portland.

Four methods occur to me, through either of which this question might be solved with a reasonable degree of accuracy.

1st. *By the average of capital cost per family on the total expenditure on account of water supply.*

This average is obtainable by dividing the whole cost by the whole number of families in the water districts of St. John and Portland, or \$988,000 by 6235; and is \$158.46⁰³/₁₀₀ fully per family.

By this process the relative interests, or amount of capital chargeable to St. John and Portland respectively, would be for

St. John— $158.46\frac{63}{100} \times 3878$ families,		\$614,509 05
Portland— $158.46\frac{63}{100} \times 2357$ “		373,490 95
Total cost,		<u>\$988,000 00</u>

2nd. *By debiting each place with the cost of its own distribution and its proportionate per family share of General Expenditure on account of land and water rights, leading mains and reservoirs, and unused stock on hand.*

This is found by dividing the whole outlay of a General character by the whole number of families, as before, or \$613,402.95 by 6235; and is $98.38\frac{6}{100}$ per family.

By this method the capital chargeable to each place would be for

St. John—Cost of distribution,		\$241,599 80
98.3806×3878 families,		381,519 95
		<u>\$623,119 75</u>
Portland—Cost of distribution,		132,997 20
98.3806×2357 families,		231,883 05
		<u>364,880 25</u>
Total cost,		<u>\$988,000 00</u>

3rd. Another way by which the relative interests of St. John and Portland may be approximated is through the *cost of their respective distributory services.*

For instance, the *whole cost* of this service was, on the 31st day of December last, \$374,597.05, and of this amount 64.50 per cent. belonged to the City and 35.52 per cent. to the Town.

Applying these percentages therefore as measures of the relative interests of St. John and Portland in that part of the outlay which does not belong to local distribution, the City

interest would be 64.50 per cent. of \$613,603 in addition to the cost of its own distribution, and the Town 35.58 per cent. in addition to the cost of its distribution. By this method the results would be as follows, viz:—

St. John—Cost of distribution, ...	\$241,599 80	
64.5 per cent. of general cost, ...	395,644 90	
		\$637,244 70
Portland—Cost of distribution, ...	132,997 25	
35.5 per cent. of general cost, ...	217,758 05	
		350,755 30
Total cost, ...		\$988,000 00

4th. Another method which might be taken with results sufficiently accurate for practical purposes would be to make the *length* of main pipe laid in St. John and Portland respectively a measure of the relative interest of each place in the General Expenditure, without regard to *cost* of distribution.

Now of the whole length of main distributing pipe laid (169,750 feet) 69.04 per cent. belongs to the City and 30.96 per cent. to Portland.

With these percentages, therefore, as measures of relative interests in General Expenditure, in addition to cost of distribution, the following results are obtained, viz:—

St. John—Cost of distribution, ...	\$241,599 80	
69.04 per cent. of general cost, ...	423,493 40	
		\$665,093 20
Portland—Cost of distribution, ...	132,997 25	
30.96 per cent. of general cost, ...	189,909 55	
		322,906 80
Total cost, ...		\$988,000 00

Either of the above methods could be taken as a basis of estimation, without doing substantial wrong to either place, as will appear when the amounts are brought closely together as on following page:

			St. John.	Portland.
Cost by No. 1 method,			\$614,509 05	\$373,490 95
Do. " 2 "			623,119 75	364,880 25
Do. " 3 "			637,244 70	350,755 30
Do. " 4 "			665,093 20	322,906 80
Averages,			634,991 67	353,008 33

The above results are not to be understood as absolutely correct, but as approximate only. Yet, as the same standards of measurements have been applied to Town and City alike they are sufficiently accurate for practical use in estimating the relative interests of St. John and Portland in their present water supply, and what should be

THE RELATIVE ANNUAL RATING

on each place for interest and maintenance.

Taking the current year as a basis of comparison, the total amount required would be about \$77,379.23. This sum represents about 7.8329 per cent. on \$988,000.00, as follows, viz:—

Interest on \$988,000.00 @ 6 p. c.,	6.0 p. c.,	\$59,280 00
Maintenance, includ'g salaries and repairs,	1.3 p. c.,	12,844 00
Losses and abatements on assessments,	0.53319 p. c.,	5,255 23
Totals,		<u>\$1.833 p. c., \$77,379 23</u>

At this rate, therefore, and the above averages of capital cost, the relative amounts leviable on each place would be about as follows, viz:—

St. John—7.8319 p. c. on \$634,991.67,		\$49,731.95
Amount levied in 1881,		58,608.11
Portland—7.8319 p. c. on \$353,008.33,		27,647.28
Amount levied in 1881,		18,771.12

This large rating on St. John compared with Portland, comes of the property rate, for water purposes, being the same in both places, and Portland having for its population a greatly smaller amount of rateable property—the average amounts per family, as already shown, being as \$3522.99 to \$1464.47; or in other words 79.83 per cent. of the rateable property is in St. John and 20.17 per cent. in Portland; while the number of families in each place is as 62.2 per cent. nearly to 37.8 per cent. fully.

This inequality in the relative amounts contributed annually by St. John and Portland must necessarily exist as long as the Tariff rates remain the same for both places and the relative amounts of taxable property continue as at present.

Respectfully submitted,

GILBERT MURDOCH,

Sup't Sewerage and Water Works.